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REMARKS

Claims 1-23, 41-75 and 94-103 are pending in the application. Of the claims, Claims 1, 14, 41, 54, and 63 are independent. To further the prosecution of this application, amendments and arguments are submitted herewith. All amended claims are believed to clearly patentably distinguish over the cited and referenced prior art.

Claims 1-23, 41-75 and 94-103 have been rejected under 35 U.S.C. 102(e) as being anticipated by Mizuno et al. (U.S. Patent No.: 5,876,325). In making this rejection the Office Action has made reference to columns 9 and 10 of Mizuno. For an understanding of the control used in Mizuno reference is also made to Figs. 1-3. In Mizuno's system the determination of the "task coordinate system", at initialization and during operation, is always performed by reading encoders associated with either the master or slave arms. Mizuno generates coordinate data "by performing geometrical vector synthesis of the rotation angles of the arms constituting either master manipulator, which have been detected by the encoders 22 provided at the joints among the arms." (*See* Mizuno, Col. 10, lines 27-29.)

The same calculation is also made with respect to the slave side of Mizuno's system. Thus, on the slave side Mizuno also calculates the position of the TCP (Tool Center Point) based upon reading encoders on the slave arms. Mizuno states that:

"the MPU 33 calculates the positions of the distal ends of the slave manipulators 3 and 4, i.e., TCP's". (*See* column 10, lines 27-29.)

Reference is also made to the diagram of Fig. 3 of Mizuno for further descriptions of the instrument control. Fig. 3 shows a manipulator 40, which is any one of the four manipulators 3, 4, 16 and 17 of the surgical manipulator system shown in Fig. 1. Fig. 3 illustrates how coordinate data is used to determine distal tool position, both initially and during operation of the system. Mizuno states that:

"The position data of the TCP of the manipulator 40, which exists in a base coordinate system 41, is obtained from the lengths of the arms 43 constituting the manipulator 40 and the rotation angles detected by the encoders 44 provided at the joints among the arms 43." (*See* Mizuno, Col. 11, lines 18-22.)

Thus, Mizuno teaches a system which requires an initial and a continuous calculation of the position of both master and slave instruments as to their distal location. This makes the algorithm more complex than that of the present invention, and thus more susceptible to failure. Accuracy and reliability are particularly important in critical surgical operations. In accordance with the present invention there is no need to make a calculation of the initial position of the slave unit, as the system of the present invention relies upon known dimensions of the slave arm and the fact that the slave arm is initially disposed in a known predefined configuration. Examples are given hereinafter of the "predefined configuration".

In accordance with the present invention the slave instrument has a predefined configuration when it is initialized. The term "predefined configuration" refers to the slave instrument being set up in a known position or location of the components of the slave instrument. As discussed in the Applicants' Specification:

> "The predefined configuration of the slave is.....defined, per FIG. 25, by the dimensions of arms Ls and Lb and by initializing the slave unit with the guide tube 17 flat in one plane (dimension Y=0) and the arm Ls in line with the Z axis." (*See* Page 78, lines 5-7 of the Applicants' Specification.)

The present application also makes it clear that the control algorithm does not use a calculation of the initial position of the slave instrument. In this regard refer to Applicants' Specification where it is stated that:

> ".....it is noted that there is an assignment of the initial position of the wrist for the slave, and that this is not a forward kinematics calculation based upon joint angles, but rather is number based upon the predefined configuration of the slave unit." (*See* Page 99, lines 17-20 of the Applicants' Specification.)

Moreover, in the present application there is a further discussion of select features of the instrument system of the present invention. The description of these features commences on page 100 of the present application. A description of a prior art system is found on page 101 at lines 1-7. In that paragraph mention is made of the fact that prior systems (such as Mizuno) involve the reading of joint angles and the computation of the forward kinematics at the slave with such a step being necessary because the joint positions of the slave were unknown at the beginning of a procedure. The Applicants' Specification further states:

"...in accordance with the present invention it is not necessary to read an initial position of the joint angles in order to determine an initial position of the distal tip of the surgical instrument. The system of the present invention.....has the initial position of the distal tip of the surgical instrument known with respect to the base of the instrument. The instrument is constructed with known dimensions, such as between base pivot 225 and the wrist (303 at axis 306 in FIG. 2D) of the tool 18. Further, the instrument is initially inserted by the surgeon in a known configuration, such as illustrated in FIGS. 9 and 10, where the dimensions and orientations of the instrument insert and adaptor guide tube are known with respect to the base (pivot 225). Therefore, an initial position of the surgical instrument distal tip need not be calculated before the system is used." (*See* Page 101, lines 8-17 of the Applicants' Specification.)

In summary, the system of the present invention teaches a much different set up for the control of the instrument from the master station, and one that is not taught, nor suggested by the cited prior art. This involves, inter alia, the establishment of an initial position by initially configuring the slave instrument in a known position, such as the position illustrated in Fig. 25, given only by way of example, and in which the guide tube 17 is flat in one plane (dimension Y=0) and the arm Ls is in line with the Z axis. Mizuno shows no such initial predefined configuration of their instrument. The initial set-up, if anything, is totally random.

Amendments have been made in the original claims to clarify the Applicants' invention. Claim 1 recites, inter alia, the step of initializing the position of the surgical instrument "without calculating its initial position." Similarly, independent claim 14 recites a method in which an initial predefined reference configuration is set "without electronic controller control". In Mizuno the initialization requires calculation, and thus claims such as claims 1 and 14, as well as their related dependent claims, should all be found in condition for allowance.

Independent Claim 41 is another method claim that includes the step of establishing a fixed position reference coordinate representative of the initial start position of the medical implement and based upon "a base point..... and an active point of the implement being in an initial known relative dimensional configuration". Mizuno does not teach an initial state of the slave unit in which the instrument is set-up with it being in a known configuration. Mizuno requires an initial calculation that the present invention does not require.

Independent Claim 54 is still another method claim that includes the step of establishing a "fixed position reference coordinate system corresponding to a fixed predefined configuration of the surgical instrument" at its initial start position. Again, Mizuno does not teach this establishment of the instrument in a predefined configuration.

Independent Claim 63 likewise is a method claim that includes the step of assigning a fixed reference coordinate to a work element of the medical implement and based upon (1) a known dimension between said work element and a base of the medical implement, and (2) the pre-selected initial configuration of the medical implement. Once again Mizuno does not teach use of known dimensions and initial configuration of the medical implement to assign a fixed reference coordinate.

In accordance with the present invention, by setting the instrument up in the same predefined configuration each time that the instrument is put into use, there is no need to make any calculation as to the location of the tip of the instrument, as its location is known by virtue of the known dimensions of the instrument and further by putting the instrument in a predefined initial configuration. One example of this is discussed in the Applicants' Specification, namely, of disposing the guide tube 17 flat in one plane (dimension Y=0) and with the arm Ls being in line with the Z axis. It is intended that other predefined configurations could also be selected, all still falling within the scope of the present invention.

In view of the above amendments and arguments it is believed that all remaining claims should now be found patentably distinguishable over the cited Mizuno et al patent, and thus in condition for allowance.

Information Disclosure Statement

An Supplemental Information Disclosure Statement (SIDS) is being filed concurrently herewith. Entry of the SIDS is respectfully requested.

CONCLUSION

In view of the above amendments and remarks, it is believed that all claims are in condition for allowance, and it is respectfully requested that the application be passed to issue. If the Examiner feels that a telephone conference would expedite prosecution of this case, the Examiner is invited to call the undersigned.

Respectfully submitted,

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